Ocean Primary Productivity

Product Description

This product provides an estimate of the Ocean Primary Productivity daily (Parameter 2602) and on an annual basis (Parameter 2606). The Level 2 product is produced daily at 1 km for local and regional areas and at 20 km for the annual productivity as a running, annual average. The Level 3 product will be produced daily at 1 km and weekly at 1 km and at 20 km for the global annual productivity.

Research & Applications

The objective of the product is to quantify the magnitude and inter-annual variability (for decadal trends) in the oceanic primary productivity and phytoplankton carbon fixation. Primary productivity is the time rate of change of phytoplankton biomass, and with allowance for excreted soluble carbon compounds, reflects the daily integrated photosynthesis within the water column. The integral of the daily values over the year is the annual primary productivity (Iverson and Esaias, 1994). The annual productivity product will be used for global and regional scale studies of interannual variability of ocean productivity, for comparisons with annual summations of daily analytic algorithms, and for comparison with global biogeochemical models.

Data Set Evolution

Ocean primary productivity algorithms fall into two general classes, termed empirical and analytic algorithms. The empirical approach is based on simple correlation between time averaged *in situ* estimates of productivity and satellite derived estimates of surface chlorophyll concentration. The analytic approach is based on models of the general photosynthetic response of the algal biomass as a function of major environmental variables such as light, temperature, and nutrient concentration. The overall methodologies differ significantly in the way various parameters are estimated and in the way they are assigned spatially and temporally across ocean basins. The approach taken for the MODIS algorithm is to begin implementation of an annual, global, empirical algorithm for at-launch product

generation, while pursuing a vigorous research program within the SeaWiFS Science Team, to develop a consensus analytic algorithm for daily global productivity. Cloudiness prevents deriving chlorophyll *a* concentrations over about 60 percent of the ocean on a daily basis excluding that already lost due to high Sun glint. Chlorophyll *a* concentrations derived from other sensors such as EOS Color and MODIS PM will be used to increase sampling frequency since these plankton processes vary rapidly over time and space.

Suggested Reading

Eppley, R.W., *et al.*, 1985.

Fitzwater, S.E., *et al.*, 1982.

Iverson, R.L., and W.E. Esaias, 1994.

Morel, A., and J.M. Andre, 1991.

Platt, T.C., *et al.*, 1991.

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PRODUCT SUMMARY

Coverage:
   global ocean surface, clear-sky only

Spatial/Temporal Characteristics:
   1 km/daily, weekly

Key Science Applications:
   ocean productivity, biogeochemical models

Key Geophysical Parameters:
   annual and daily ocean productivity

Processing Level:
   2, 3

Product Type:
   standard, at-launch

Science Team Contact:
   W. Esaias, M. Abbott
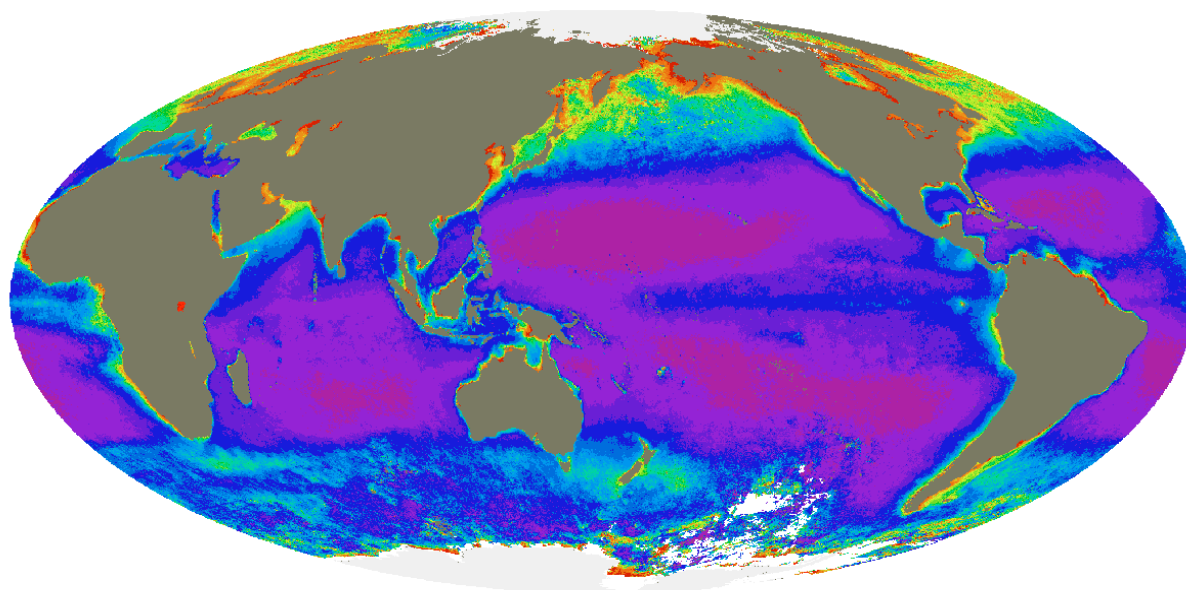
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Figure 39. **Global Ocean Phytoplankton Biomass.** A pre-MODIS, global ocean color product from the Coastal Zone Color Scanner shows the algal pigment concentrations within the upper layers of the ocean and indicates the biomass and productivity distribution within the oceans. While this is an annual product, MODIS will provide comparable global coverage on a weekly to monthly basis to enable scientists to study large-scale changes in marine ecosystems over weeks to decades. *NASA, GSFC*